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Technology Assessment Program

NIJ Standard-0605.00

Color Test Reagents/ Kits for Preliminary Identification of Drugs of Abuse

A Program of the National Institute of Justice

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The Technology Assessment Program is sponsored by the Office of Development, Testing, and Dissemination of the National Institute of Justice (NIJ), U.S. Department of Justice. The program responds to the mandate of the Justice System Improvement Act of 1979, which created NIJ and directed it to encourage research and development to improve the criminal justice system and to disseminate the results to Federal, State, and local agencies.

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Paul Cascarano, Director
Office of Development, Testing,
and Dissemination
National Institute of Justice

Technology Assessment Program

NIJ Standard for Color Test Reagents/Kits for Preliminary Identification of Drugs of Abuse

A Voluntary National Standard Promulgated by the National Institute of Justice.

JULY 1981

U.S. DEPARTMENT OF JUSTICE
National Institute of Justice

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Harry M. Bratt, Acting Director

ACKNOWLEDGMENTS

This standard was formulated by the Law Enforcement Standards Laboratory of the National Bureau of Standards under the direction of Jacob J. Diamond and Lawrence K. Eliason, successive Chiefs of LESL. It is based on technical research performed by the staff of the NBS Analytical Chemistry Division under the supervision of Dr. Rance A. Velapoldi. The standard has been reviewed and approved by the Technology Assessment Program Information Center of the International Association of Chiefs of Police and adopted by them as an IACP Standard.

NIJ STANDARD FOR COLOR TEST REAGENTS/KITS FOR PRELIMINARY IDENTIFICATION OF DRUGS OF ABUSE

CONTENTS

	Page
Foreword	v
1. Purpose	1
2. Scope	1
3. Definitions	1
4. Requirements	1
4.1 User Information	1
4.2 Labeling	2
4.3 Workmanship	2
4.4 Safe-Disposal Materials	2
4.5 Color Samples	2
4.6 Test Color and Sensitivity	2
4.7 Drug Detection Limit	2
5. Test Methods	4
5.1 General Test Conditions	4
5.2 Test Color and Sensitivity Determination	4
5.3 Drug Detection Limit Determination	4
Appendix A	5

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FOREWORD

This document, NIJ Standard-0605.00, Color Test Reagents/Kits for Preliminary Identification of Drugs of Abuse, is an equipment standard developed by the Law Enforcement Standards Laboratory of the National Bureau of Standards. It is produced as part of the Technology Assessment Program of the National Institute of Justice. A brief description of the program appears on the inside front cover.

This standard is a technical document that specifies performance and other requirements equipment must meet to conform to the needs of criminal justice agencies for high quality service. Purchasers can use the test methods described in this report to determine firsthand whether a particular piece of equipment meets the standards, or they may have the tests conducted on their behalf by a qualified testing laboratory. Procurement officials may also refer to this standard in their purchasing documents and require that equipment offered for purchase meet the requirements, with compliance guaranteed by the vendor or attested to by an independent laboratory.

Because this NIJ standard is designed as a procurement aid, it is necessarily highly technical. For those who seek general guidance about the capabilities of color test reagents/kits for preliminary identification of drugs of abuse, user guides also are published. The guides explain in non-technical language how to select equipment capable of the performance required by an agency.

NIJ standards are subjected to continuing review. Technical comments and recommended revisions are welcome. Please send suggestions to the Program Manager for Standards, National Institute of Justice, U.S. Department of Justice, Washington, DC 20531.

Before citing this or any other NIJ standard in a contract document, users should verify that the most recent edition of the standard is used. Write to: Chief, Law Enforcement Standards Laboratory, National Bureau of Standards, Washington, DC 20234.

Lester D. Shubin
Program Manager for Standards
National Institute of Justice

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NIJ STANDARD FOR COLOR TEST REAGENTS/KITS FOR PRELIMINARY IDENTIFICATION OF DRUGS OF ABUSE

1. PURPOSE

The purpose of this standard is to establish minimum requirements for color test reagents/kits for drugs of abuse and methods of testing the reagents to determine compliance with those requirements.

2. SCOPE

This standard applies to field testing kits which consist of color test reagents for the preliminary identification of drugs of abuse (hereinafter referred to simply as drugs). It does not apply to kits which use thin layer chromatography as the identification procedure nor to kits which identify drugs in body fluids.

This standard is an adaptation of NILECJ standard 0604.00 for "Chemical Spot Test Kits for Preliminary Identification of Drugs of Abuse." The kits addressed in that standard are designed to identify drugs with a substantial degree of specificity by means of (in general) sequential tests with several chemical reagents in accordance with an objective test protocol. In contrast, this standard is concerned with single reagents (or reagent combinations) that are used to give a preliminary confirmation of the identity of a suspected drug or class of drugs.

Note that this standard does not mandate the identities of the reagents to be included in a test kit. The eleven reagents listed in appendix A are included for informational purposes only, since they are among the reagents currently in common use. A kit may contain any reagent or group of reagents that meet the requirements of this standard.

3. DEFINITIONS

3.1 Centroid Color Charts

A collection of charts, published by the Inter-Society Color Council and the National Bureau of Standards, which logically group and illustrate the colors. There is a chart for each color hue. On each chart, color saturation increases from left to right and color lightness increases from bottom to top. The charts are identified as NBS Standard Reference Material 2106 and are described in NBS Circular 553. The charts may be purchased from the Office of Standard Reference Materials, and the circular may be obtained from the Office of Technical Publications, both at the National Bureau of Standards, Washington, D.C. 20234.

3.2 Final Color

The color, generally formed within one or two minutes, that remains after any intermediate colors, produced by the addition of a reagent to a drug or other substance, have disappeared.

4. REQUIREMENTS

4.1 User Information

The kit shall include the following information.

4.1.1 Drugs Detected

The identity of the drug or drugs for which each reagent in the kit can be used to make a tentative identification.

4.1.2 Instructions

Clear instructions for performing each chemical test and for interpreting the results, including the time required for the final color to appear.

4.1.3 Safety Precautions

a) Warning of the hazards of the flammable and corrosive chemicals contained in the kit.

b) Steps to follow and antidotes to use if hazardous reagents are taken internally or come in contact with parts of the body or clothes.

c) Procedures for safely discarding used reagents and containers.

4.1.4 General

a) A statement that the reagents in the kit are intended to be used for presumptive purposes only, and that all substances tested should be subjected to more definitive examination by qualified scientists in a crime laboratory.

b) A statement that users of the kit should receive appropriate training in its use, and should be taught that the reagents can give false positive as well as false negative results.

c) A discussion of the possibility of reagent and/or sample contamination and consequent misleading results.

4.2 Labeling

Each reagent container shall have a label which either directly or by reference:

a) Identifies the reagent.

b) Identifies the drug or drugs which it can detect.

c) Is prominently marked "Danger," where appropriate.

d) Gives a discard date, where appropriate.

4.3 Workmanship

Visual inspection of the kit shall show no broken or inoperative catches, hinges or containers. There shall be no evidence of reagent leakage.

4.4 Safe-Disposal Materials

The kit shall contain chemicals for neutralizing strongly acidic and basic reagents and/or acid/base-resistant containers into which used reagents and containers can be deposited and safely disposed of at a later time in accordance with 4.1.3.c.

4.5 Color Samples

The kit shall include a sample or reproduction of the color or colors produced by each reagent in the kit when reacted with each drug listed on the reagent container label.

4.6 Test Color and Sensitivity

Each reagent in the kit shall produce the color or colors that are specified by the manufacturer in the form of color samples (par. 4.5), or have the same color hue and color saturation as those colors, for each of five replicate tests, performed in accordance with paragraph 5.2 at the drug detection limit listed in table 1 or specified by the manufacturer in accordance with paragraph 4.7. If a reagent produces the same color with more than one drug, this test need be performed for only one of those reagent/drug combinations.

4.7 Drug Detection Limit

The manufacturer shall specify the drug detection limit, determined in accordance with paragraph 5.3, for each drug/reagent combination listed on a reagent container label, other than those listed in table 1. For any drug listed in table 2, the numerical value of the limit shall not exceed that listed in table 2.

TABLE 1. *Drug detection limits and drug solvents*

Reagent	Drug	Drug detection limit, μg	Solvent
A.1	Cocaine·HCl	60.0	$CHCl_3$
A.1	Methadon·HCl	15.0	$CHCl_3$
A.2	Amobarbital	100.0	$CHCl_3$
A.2	Pentobarbital	100.0	$CHCl_3$
A.2	Phenobarbital	100.0	$CHCl_3$
A.2	Secobarbital	100.0	$CHCl_3$
A.3	Marijuana	350.0[1]	——
A.3	Tetrahydrocannabinol (THC)	2.0	$CHCl_3$
A.4	Codeine Sulfate	5.0	H_2O
A.4	D-Amphetamine·HCl	10.0	$CHCl_3$
A.4	Heroin·HCl	20.0	$CHCl_3$
A.4	D-Methamphetamine·HCl	150.0	$CHCl_3$
A.4	Morphine	5.0	$CHCl_3$
A.5	Codeine Sulfate	1.0	H_2O
A.5	D-Amphetamine·HCl	10.0	$CHCl_3$
A.5	Heroin·HCl	10.0	$CHCl_3$
A.5	LSD Tartrate	5.0	H_2O
A.5	Mescaline Sulfate	1.0	H_2O
A.5	Methadon·HCl	1.0	$CHCl_3$
A.5	d-Methamphetamine·HCl	5.0	$CHCl_3$
A.5	Morphine	5.0	$CHCl_3$
A.6	Mescaline Sulfate	1.0	H_2O
A.7	LSD Tartrate	5.0	H_2O

[1] This quantity of marijuana assumes 0.5 percent active ingredients.

TABLE 2. *Maximum acceptable drug detection limits for reagents other than A.1 through A.7 (see appendix A)*

Drug	μg
Cocaine·HCl	600
Codeine Sulfate	50
D-Amphetamine·HCl	100
Heroin·HCl	200
LSD Tartrate	50
Marijuana	1000[1]
Tetrahydrocannabinol (THC)	6[2]
Mescaline Sulfate	10
Methadon·HCl	150
d-Methamphetamine·HCl	500
Morphine	50
Phenobarbital	1000

[1] This quantity of marijuana assumes 0.5 percent active ingredients.

[2] This quantity of THC assumes 100 percent active ingredients.

5. TEST METHODS

5.1 General Test Conditions

At the time of the tests, the ambient temperature shall be between 10 °C and 40 °C (50 °F and 104 °F); the relative humidity shall be between 10 and 90 percent.

5.2 Test Color and Sensitivity Determination

5.2.1 Marijuana Preparation

For marijuana, transfer a quantity equal to the drug detection limit into each of five test containers and proceed in accordance with paragraph 5.2.3. If Tetrahydrocannabinol (THC) is used for testing purposes, prepare it in accordance with paragraph 5.2.2.

5.2.2 Other Drug Preparation

For all other drugs, prepare a 1.0 $\mu g/\mu L$ solution of the drug in a reagent grade solvent. Chloroform and distilled water are convenient solvents for the drugs listed in table 1, as indicated.

Transfer by micropipette into each of five test containers the volume of drug solution, in μL, numerically equal to the drug detection limit, in μg, listed in table 1 or specified by the manufacturer in accordance with paragraph 4.7.

Evaporate the solvent by infrared heating and/or by gently blowing a stream of gas such as oil-free air, nitrogen, helium, etc., over the surface of the solution. Keep heating time to a minimum by heating only until the solvent is evaporated, to avoid the possibility of drug decomposition. The temperature of the solution should not exceed 40 °C (104 °F) during solvent evaporation.

5.2.3 Procedure

If the kit is packaged with the reagents in sealed glass tubes for single test field purposes, break the reagent tubes in suitable individual containers such as small beakers or test tubes. Use a disposable pasteur-type pipette (Kimble No. 72060, or equivalent) to transfer one drop (approximately 0.1 mL) of each reagent being tested, in the sequence specified by the manufacturer if appropriate, to each of the five drug test specimens prepared in paragraph 5.2.1 and/or 5.2.2 above.* Allow the drop of reagent to run down the side of the container onto the drug. Compare the color or colors produced within the specified time limits, to those provided by the manufacturer in accordance with paragraph 4.5, and determine whether the colors are essentially the same.

5.3 Drug Detection Limit Determination

Prepare a solution, using a suitable reagent grade solvent, having a drug concentration of 1.0 $\mu g/\mu L$, or lower if necessary. Using a micropipette, transfer five samples of a convenient volume of this solution to test containers. Evaporate the solvent and add reagent, as described in paragraph 5.2. Change the quantity of drug transferred to the test containers by varying either the solution concentration or the volume transferred, and repeat the test until the smallest mass of transferred drug is determined, to one significant figure, for which five out of five color changes are observed. As a safety factor, multiply this quantity by ten, and use the product as the operational drug detection limit.

*When two or more reagents are used sequentially, transfer the minimum number of drops of each reagent that is equivalent to the ratio specified by the manufacturer (i.e., three drops to one, three drops to two, etc.).

APPENDIX A—REAGENTS

Use reagent grade chemicals.

A.1 Cobalt(II) Thiocyanate

Dissolve 2.0 grams (g) of cobalt (II) thiocyanate in 100 milliliters (mL) of distilled water.

A.2 Dille-Koppanyi Reagent, Modified

Solution A. Dissolve 0.1 g of cobalt (II) acetate dihydrate in 100 mL of methanol. Add 0.2 mL of glacial acetic acid and mix.

Solution B. Add 5 mL of isopropylamine to 95 mL of methanol.

Procedure. Add 2 volumes of solution A to the drug, followed by 1 volume of solution B.

A.3 Duquenois-Levine Reagent, Modified

Solution A. Add 2.5 mL of acetaldehyde and 2.0 g of vanillin to 100 mL of 95 percent ethanol.

Solution B. Concentrated Hydrochloric Acid.

Solution C. Chloroform.

Procedure. Add 1 volume of solution A to the drug and shake for 1 minute. Then add solution B. Agitate gently, and determine the color produced. Add 3 volumes of solution C and and agitate. If the designated color is extracted into solution C, the test is positive.

A.4 Mandelin Reagent

Dissolve 1.0 g of ammonium vanadate in 100 mL of concentrated sulfuric acid.

A.5 Marquis Reagent

Carefully add 100 mL of concentrated sulfuric acid to 5 mL of 40 percent formaldehyde (v:v, formaldehyde:water).

A.6 Nitric Acid

Concentrated.

A.7 Para-Dimethylaminobenzaldehyde (p-DMAB)

Add 2.0 g of p-DMAB to 50 mL of 95 percent ethanol and 50 mL of concentrated hydrochloric acid.

A.8 Ferric Chloride

Dissolve 2.0 g of anhydrous ferric chloride or 3.3 g of ferric chloride hexahydrate in 100 mL of distilled water.

A.9 Froehde Reagent

Dissolve 0.5 g of molybdic acid or sodium molybdate in 100 mL of hot concentrated sulfuric acid.

A.10 Mecke Reagent

Dissolve 1.0 g of selenious acid in 100 mL of concentrated sulfuric acid.

A.11 Zwikker Reagent

Solution A. Dissolve 0.5 g of copper (II) sulfate pentahydrate in 100 mL of distilled water.

Solution B. Add 5 mL of pyridine to 95 mL of chloroform.

Procedure. Add 1 volume of solution A to the drug, followed by 1 volume of solution B.

TABLE A-1. *Final colors produced by reagents A.1 through A.11 with various drugs and other substances*

Material	Reagent	Final Color (ISCC-NBS)
Benzphetamine	A.1	169. s. g B
Brompheniramine	A.1	168. brill. g B + 177 brill. B
Chlorpromazine·HCl	A.1	168. brill. g B
Cocaine·HCl	A.1*	169. s. g B + 178. s. B
Darvon (propoxyphene·HCl)	A.1	169. s. g B
Demerol·HCl	A.1	169. s. g B
Doxepin·HCl	A.1	169. s. g B
Heroin·HCl	A.1	169. s. g B
Librium	A.1	181. l. B
Marezine (cyclizine·HCl)	A.1	171. v. l. g B
Methadon·HCl	A.1*	181. l. B
Methapyrilene·HCl	A.1	169. s. g B
Opium	A.1	146. d. G
Phencyclidine	A.1	168. brill. g B
Procaine·HCl	A.1*	169. s. g B + 178. s. B
Quinine, Quinine Salts	A.1	178. s. B
Ritalin	A.1	168. brill, g B
Contac	A.2	31. p. y Pk
Pentobarbital	A.2*	218. s. P
Phenobarbital	A.2*	218. s. P
Secobarbital	A.2*	218. s. P
Tea	A.2	29. m. y Pk
Mace	A.3	237. s. r P^2 237. s. r P^3 221. v. l. P^4
Marijuana	A.3*	197. deep p B^2 186. gy. B^3 220. v. deep P^4
Nutmeg	A.3	244. p. r P^2 244. p. r P^3 226. v. p. P^4
Tea	A.3	243. v. d. r P^5
Aspirin	A.4	113. Ol Gy
Benzphetamine	A.4*	119. l. Y G
Brompheniramine	A.4	50. brill. O
Chlorpromazine·HCl	A.4	107. m. Ol + 13. deep R
Cocaine·HCl	A.4*	51. deep O
Codeine Sulfate	A.4*	107. m. Ol
Contac	A.4	84. s. Y
D-Amphetamine·HCl	A.4*	164. m. b G
D-Methamphetamine·HCl	A.4*	136. m. y G
Darvon (propoxyphene·HCl)	A.4	44. d. r Br
Doxepin·HCl	A.4	21. blackish R
Dristan	A.4	127. gy. Ol G

Excedrin	A.4	108. d. Ol
Heroin·HCl	A.4*	43. m. r Br
L-Isomethadon·HCl	A.4	243. v. d. r P
Mace	A.4	46. gy. r Br
MDA·SO_4 (3,4-methylene-dioxyamphetamine)	A.4	235. p Black
Mescaline Sulfate	A.4*	65. br Black
Methadon·HCl	A.4	183. d. B
Methapyrilene·HCl	A.4	243. v. d. r P + 260. v. d. p R
Methaqualone	A.4	35. s. r O
Methyprylon	A.4	184. v. p. B
Morphine	A.4*	47. d. gy. r Br
Opium	A.4*	94. l. Ol Br
Oxycodone·HCl	A.4	68. s. O Y
Procaine·HCl	A.4	51. deep O
Quinine	A.4	108. d. Ol
Ritalin	A.4	68. s. O Y
Salt, iodized	A.4	51. deep O
STP·HCl (2,5-dimethoxy-4-methylamphetamine)	A.4*	117. s. Y G
TMA·HCl (trimethoxy-amphetamine)	A.4*	94. l. Ol Br
Aspirin	A.5	12. s. R
Benzphetamine	A.5*	41. deep r Br
Chlorpromazine·HCl	A.5	260. v. d. p R
Codeine Sulfate	A.5*	212. d. V
D-Amphetamine	A.5*	44. d. r Br + 34. v. r O
D-Methamphetamine·HCl	A.5*	44. d. r Br + 34. v. r O
Darvon (propoxyphene·HCl)	A.5	230. blackish P
Demerol·HCl	A.5	56. deep Br
Doxepin·HCl	A.5	21. blackish R
Dristan	A.5	241. m. r P
Excedrin	A.5	15. m. R
Heroin·HCl	A.5*	239. v. deep r P
LSD Tartrate	A.5	235. p Black
Mace	A.5	244. p. r P
Marezine (cyclizine·HCl)	A.5	98. brill. g Y
MDA·SO_4 (3,4-methylene-dioxyamphetamine)	A.5*	267. Black
Mescaline Sulfate	A.5*	36. deep r O
Methadon·HCl	A.5	28. l. y Pk
Methapyrilene·HCl	A.5	260. v. d. p R[6]
Morphine	A.5*	243. v. d. r P
Opium	A.5*	44. d. r Br
Oxycodone·HCl	A.5*	201. d. p Br
Pentobarbital	A.5	78. d. y Br
Phencyclidine	A.5	7. p. Pk
Phenobarbital	A.5	78. d. y Br
Ritalin	A.5	71. m. O Y
Secobarbital	A.5	78. d. y Br

STP-HCl (2,5-dimethoxy-4-methylamphetamine)	A.5*	101. l. g Y
Sugar	A.5	46. gy. r Br
TMA-HCl (trimethoxy-amphetamine)	A.5*	36. deep r O
Chlorpromazine-HCl	A.6	101. l. g Y
Codeine Sulfate	A.6*	101. l. g Y
Doxepin-HCl	A.6	84. s. Y
Excedrin	A.6	68. s. O Y
Heroin-HCl	A.6*	89. p. Y
LSD Tartrate	A.6	54. br O
Mace	A.6	40. s. r Br
MDA-SO_4 (3,4-methylene-dioxyamphetamine)	A.6	101. l. g Y
Mescaline Sulfate	A.6*	41. deep r Br
Methapyrilene-HCl	A.6	44. d. r Br
Morphine	A.6*	67. brill. O Y
Opium	A.6*	101. l. g Y
Oxycodone-HCl	A.6	86. l. Y
STP-HCl (2,5-dimethoxy-4-methylamphetamine)	A.6	89. p. Y
TMA-HCl (trimethoxyamphetamine)	A.6	14. v. deep R
LSD Tartrate	A.7*	219. deep P
Baking Soda	A.8	43. m. r Br
Excedrin	A.8	260. v. d. p R
Morphine	A.8*	67. brill. O Y
Aspirin	A.9	228. gy. P
Chlorpromazine-HCl	A.9	21. blackish R
Codeine Sulfate	A.9*	147. v. d. G
Darvon (propoxyphene-HCl)	A.9	230. blackish P
Doxepin-HCl	A.9	41. deep r Br
Dristan	A.9	163. l. b G
Excedrin	A.9	148. v. p G
Heroin-HCl	A.9*	256. deep p R
LSD Tartrate	A.9	138. v. d. y G
Mace	A.9	257. v. deep p R
Marezine (cyclizine-HCl)	A.9	101. l. g Y
MDA-SO_4 (3,4-methylene-dioxyamphetamine)	A.9*	157. g Black
Mescaline Sulfate	A.9*	84. s. Y
Methapyrilene-HCl	A.9	65. br Black
Morphine	A.9*	67. brill. O Y
Opium	A.9*	96. d. Ol Br
Oxycodone-HCl	A.9	84. s. Y
Phencyclidine	A.9	7. p. Pk
STP-HCl (2,5-dimethoxy-4-methylamphetamine)	A.9*	117. s. Y G
TMA-HCl (trimethoxy-amphetamine)	A.9*	183. d. Blue
Benzphetamine	A.10*	101. l. g Y
Chlorpromazine-HCl	A.10	111. d. gy. Ol + 108. d. Ol
Codeine Sulfate	A.10*	175. v. d. g B

Darvon (propoxyphene-HCl)	A.10	41. deep r Br
Doxepin-HCl	A.10	21. blackish R
Dristan	A.10	94. l. Ol Br
Excedrin	A.10	93. y Gy
Heroin-HCl	A.10*	161. deep b G
LSD Tartrate	A.10	152. blackish G
L-Isomethadon-HCl	A.10	7. p. Pk
Mace	A.10	111. d. gy. Ol
Marezine (cyclizine-HCl)	A.10	98. brill. g Y
MDA-SO_4 (3,4-methylene-dioxyamphetamine)	A.10*	183. d. B
Mescaline Sulfate	A.10*	114. Ol Black
Methapyrilene-HCl	A.10	230. blackish P
Morphine	A.10*	166. v. d. b G
Nutmeg	A.10	65. br Black
Opium	A.10*	114. Ol Black
Oxycodone-HCl	A.10	107. m. Ol
Phencyclidine	A.10	7. p. Pk
STP-HCl (2,5-dimethoxy-4-methylamphetamine)	A.10*	118. deep Y G
TMA-HCl (trimethoxy-amphetamine)	A.10*	75. deep y Br
Baking Soda	A.11	181. l. B
Excedrin	A.11	144. l. G
Mace	A.11	120. m. Y G
Pentobarbital	A.11*	222. l. P
Phenobarbital	A.11*	222. l. P
Secobarbital	A.11*	222. l. P
Tea	A.11	120. m. Y G
Tobacco	A.11	136. m. y G

(+) means "and/or."
(*) means common reagent for that drug.
[1] Color abbreviations used:

B	= blue	gy.	= grayish	pk	= pinkish
b	= bluish	l.	= light	R	= red
Br	= brown	m.	= moderate	r	= reddish
br	= brownish	med.	= medium	s.	= strong
brill.	= brilliant	O	= orange	V	= violet
d.	= dark	Ol	= olive	v.	= very or vivid
G	= green	P	= purple	Y	= yellow
g	= greenish	p	= purplish	y	= yellowish
Gy	= gray	p.	= pale		
		Pk	= pink		

[2] Aqueous phase.
[3] Aqueous phase after chloroform extraction.
[4] Chloroform phase (marijuana extraction usually rapid compared to other materials).
[5] Not extracted into chloroform.
[6] Precipitate.

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